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NATIONAL STANDARD FOR V5.2 INTERFACE

STANDARDS
No. TEC/SD/SW/VAN-SIG/03.MAR.2010
(SUPERSEDES SD/VAN - 02/02.FEB 2006)

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TELECOMMUNICATION ENGINEERING CENTRE
DEPARTMENT OF TELECOMMUNICATIONS
NEW DELHI

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HISTORY SHEET

S. No.	Title	GR No.	Remarks
1.	NATIONAL STANDARD FOR V5.2 INTERFACES	G/VAN - 02/01.SEP 96	Issue 01
2.	NATIONAL STANDARD FOR V5.2 INTERFACES	ADDENDUM 1 TO G/VAN - 02/01.SEP 96	Added sub-clauses after clause 3.1 are: 3.1.1: Start up procedure 3.1.2: Accelerated Port Alignment 3.1.3: Communication channel defined Call Scenario: Changes in Caller ID feature
3.	NATIONAL STANDARD FOR V5.2 INTERFACE	SD/VAN - 02/02.FEB 2006	Issue 02 Added sub-clauses to clause 4 to take into account changes in G.965 (2001). 4.1 Elements of procedures and formats of fields for data link sub layer peer-to-peer communication 4.2 Reject cause information element 4.3 Protection protocol specification 4.4 Interoperability
4.	NATIONAL STANDARD FOR V5.2 INTERFACE	TEC/SD/SW/VAN-SIG/03. FEB.2010	Issue 03 • Document is in new the format • Functional requirements have been elaborated

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CHAPTER 1

INTRODUCTION

1.1 The National Standard for V5.2 interface specifies the electrical, physical, procedural and protocol requirements for inter-working between an Access Network (AN) and the Local Exchange (LE) for the support of all access types including ISDN basic access and primary rate access as defined in ITU-T Recommendations G.965 (1995).

1.2 This Standard shall ensure proper inter-working between AN and LE in a multi-vendor environment in a telecom network.

1.3 National options for PSTN signalling protocol are defined in this standard to suit the requirements of the national PSTN. All other requirements for V5.2 interface including protocol requirements for ISDN, control protocol, BCC protocol, protection protocol and link control protocol shall be as per ITU-T Recommendations G.965 (1995).

1.4 V5.2 interface consists of up to a maximum of sixteen 2048 kbit/s links. The functional and procedural requirement of each of the 2048 link shall be the same as for ITU-T Recommendation G.964.

1.5 Line and user port testing and other related control functions which were previously LE functions shall be supported by AN through Q_{AN} interface and are not within the scope of this specification.

1.6 It shall be the responsibility of the equipment providers to ensure that the PSTN signal information elements are provided in accordance with the national PSTN protocol.

CHAPTER 2

DESCRIPTION

2.1 V5.2 is a telephone network protocols defined by ETSI which allow communications between the telephone exchange, also known as the local exchange (LE), and the local loop. With potentially thousands of subscribers connected to the LE there is the problem of physically managing thousands of wires out to the local subscribers (and the costs associated with that).

2.2 The V5 protocol stack is used for the connection of an Access Network (AN) to a Local Exchange (LE). It is used for the following access methods:

i. Analog telephone access.

ii. ISDN basic rate access.

iii. ISDN primary rate access (V5.2).

iv. Other analog or digital accesses for semi-permanent connections without associated outband signalling information.

2.3 Access Network (AN) and Local Exchange (LE) are defined as

A. Access Network (AN): A system implemented between the Local Exchange (LE) and user, replacing part or the whole of the local line distribution network.

B. Local Exchange (LE): An exchange on which user lines are terminated via an AN

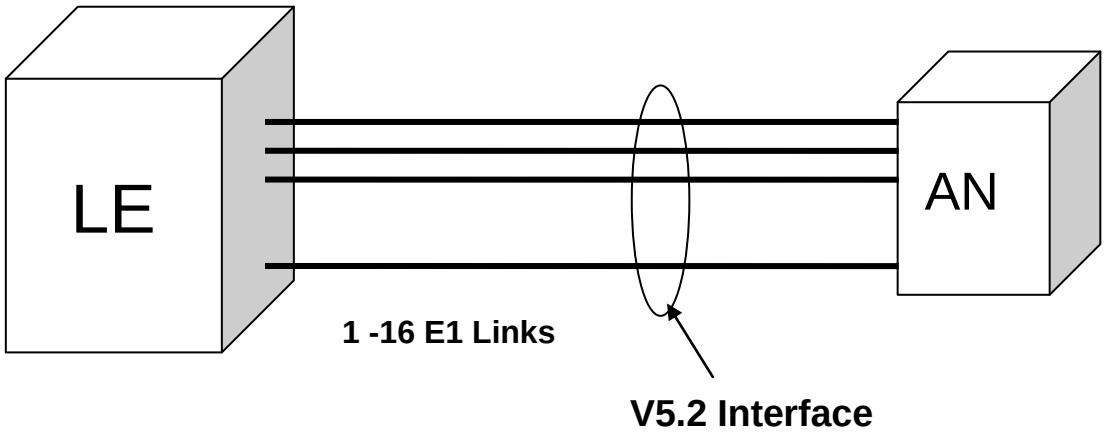
C. V5.2 Interface: Interface for connection of ANs to the LE

2.4 The V5.2 protocol groups the subscribers and the PCM trunks connecting them to the LE as Interfaces. Each V5.2 Interface defines a group of trunks and subscriber ports. Message communication for the Interface takes place over control channels defined for the interface. Generally, a primary and a secondary control channel are defined for communication.

2.5 V5.2 protocol provided a standard set of protocols from the subscriber to the LE. The AN (or Access Network) is defined as a reference point. Signalling between this point i.e. AN and the LE is standardised and therefore allowed a multiple vendor solution. This resulted in multiple links from the AN to the LE, reducing the need for many lines along this point. The final link to the local loop remained the same with digital signalling ((ISDN) and analogue signalling for basic telephony (POTS).

2.6 V5.2 protocol is based on the principle of common channel signalling where message-based signalling for all subscribers uses the same signalling channel(s) rather than separate channels existing for different subscribers. It means, it is a message based protocol and any event such as on-hook/off-hook translates into a message. These subscriber messages/signals are multiplexed in one or more communication channels

2.7 V5.2 (*ETS 300 347-1*) provides for concentration where there are not enough bearer channels in the aggregate link(s) to accommodate all subscribers at the same time. A single V5.2 interface can control up to 16 E1 links at once and can include protection of the signalling channels.



V5.2 Interface (LE – AN connectivity)

Fig. 1

2.8 For analog access, on the LE side signalling from the PSTN user port is converted into a functional part of the V5 protocol for signalling to the AN side. For ISDN users a control protocol is defined in the V5 for the exchange of the individual functions and messages required for the coordination with the call control procedures in the Local Exchange.

- A bearer channel connection protocol establishes and de-establishes bearer connections required on demand, identified by the signalling information, under the control of the Local Exchange.
- A link control protocol is defined for the multi-link management to control link identification, link blocking and link failure conditions.
- A protection protocol, operated on two separate data links for security reasons, is defined to manage the protection switching of communication channels in case of link failures.

CHAPTER 3
FUNCTIONAL REQUIREMENTS

3. NATIONAL OPTIONS FOR PSTN SIGNALLING PROTOCOL

National options for PSTN signalling protocol are defined in the following paragraphs to suit the requirements of the national PSTN. All other requirements for V5.2 interface shall be as per ITU-T Recommendations G.965 (1995).

3.1. Functional split between LE and AN

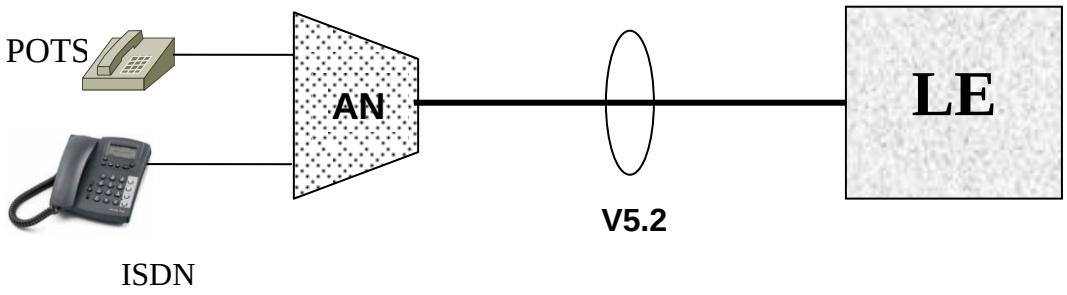


Fig. 2

3.1.1. AN shall handle access specific parameters related to protocol such as recognition times of the analogue signals, duration, voltage and frequency of the metered pulses, ringing current or the specific details of signalling sequence (AN part of the national protocol entity). These parameters shall be either in hardware, software or in data. In the latter case this data shall be pre-defined but the recognition times of steady state and pulse type signals mentioned in this document shall be over ruled by "protocol parameter" messages via V5.2 interface for a call.

3.1.2. AN shall provide physical connection of subscriber lines. It shall convert subscriber line signal in to V5.2 message. It shall digitalize the digit evaluation in case of decadic dialing. In addition it shall perform subscriber line testing.

3.1.3. The LE shall be responsible for providing the services call control (i.e. call processing) and supplementary services. DTMF senders, receivers, tone generators and announcements shall be located in the LE.

3.1.4. LE shall be perform function of d-channel signaling, assignment/release of communication channels and charging.

3.1.5. Address information using DTMF shall be carried transparently between user port and LE whereas line state signalling shall be interpreted in the AN and then carried over the V5.2 interface by means of layer 3 messages.

3.1.6. AN shall handle access specific parameters related to protocol such as recognition times of the analogue signals, duration, voltage and frequency of the metered pulses, ringing current or the specific details of signalling sequence (AN part of the national protocol entity). These parameters shall be either in hardware, software or in data. In the latter case this data shall be pre-defined but the recognition times of steady state and pulse type signals mentioned in this document shall be over ruled by "protocol parameter" messages via V5.2 interface for a call.

3.1.7. The AN shall respond autonomously for time critical responses to customer signaling. For ring trip and dial tone suppression etc. These protocols have been defined in detail in clause 13.1.2 of ITU-T Recommendation G.964.

3.2. **Start Up Procedure:**

3.2.1 Local Exchange (LE) shall support start up procedure of V5.2 interface in different configurations. Different options, including link identification procedure, shall be programmable by MML on the basis of link.

3.2.2 Link activation shall be possible even if AN or LE does not support link identification procedure.

3.2.3 Start up of V5.2 interface shall be successful even with secondary link as an active link. Further, start up of V5.2 interface shall be successful even on single E1 link although data defined in LE and AN is for more than one link.

3.2.4 During start up, LE and AN shall try to establish communication on both the primary and secondary link either simultaneously or alternately till a successful link is established.

3.2.5 V5.2 interface shall define the lower three layers of OSI stack (i.e. physical layer, data link layer and network layer) that are used in connecting AN to LE.

3.3. **Accelerated Port Alignment**

3.3.1 Accelerated Port Alignment (APA) shall be supported by the LE and AN as per ETSI 300 347-1.

3.3.2 It shall be possible to define by MML in LE whether APA

i. Shall be supported during Startup procedure, independently of what triggers the Startup procedure.

ii. Shall not be supported during Startup procedure, independently of what triggers the Startup procedure.

3.3.3 AN shall always respond to the alignment procedure initiated by LE

3.3.4 LE shall respond to the coordinated blocking/unblocking that may immediately follow APA. However after APA, AN shall initiate coordinated blocking/unblocking only for ports which have not been initialized by APA.

3.4. Control protocol support:

V5.2 protocol shall have following control protocols:

- Common control & Port Control
- Link Control
- Bearer channel connection (BCC)
- Protection

3.4.1 Control protocol shall be used to exchange the individual port status and control functions required to coordinate for call control procedure in LE. It shall consist of:-

i. Port Control – It shall be used to block/unblock the user ports

ii. It shall check the provisioning variant and interface ID. It ensures proper functioning of the entire V5.2 interface

3.4.2 Link control protocol: It shall be used for multi-link management to control link identification, link blocking/unblocking and link failure condition

3.4.3 Protection Protocol: It shall operate on two separate data links for security reasons and shall manage the protection switching of communication channels in case of 2048 kbps link failures in a multi-link environment.

3.4.4 PSTN protocol (Signalling for analog subscriber): It shall convert the signaling from PSTN user port into stimulus protocol with a funtional part for the signaling path, using layer 3 multiplexing for the information from different ports. It shall transfer information of ‘analogue line state’ over v5.2 interface.

3.4.5 BCC protocol: It shall be under the control of LE. It shall establish and de-establishes bearer connection dynamically on a specific 2048 kbps link to user ports on a call by call basis as per requirement. That is, it shall perform the function of timeslot assignment/ release for a user port.

3.4.6 ISDN signaling:

i. SDN-D protocol – It shall provide signaling for ISDN basic access and shall frame relays the information from ISDN D-channel in AN

ii. ISDN-P protocol – It shall provide packet data for ISDN basic access

3.4.7 In protection group 1 all the protocols including ISDN and PSTN shall be created on TS16 of the E1 link chosen as primary link.

3.4.8 TS16 of second E1 link shall function as secondary link. Secondary link shall be programmable on any PCM

3.4.9 PSTN and ISDN protocols shall also be programmable on second or additional communication channel, with protection group 2, in LE. AN shall be flexible to implement second communication channel as per implementation in LE.

3.5. All the messages for PSTN protocol mentioned in Table 16 of ITU-T Recommendation G.964 shall be applicable.

3.6. All the information elements given in Table 17 of ITU-T Recommendation G.964 shall be applicable. The information elements for which national options have been defined are described in the following sub-paras:

3.6.1 **Cadence Ringing**

The purpose of Cadenced-ringing information element is to indicate to the AN that ringing with a certain pre-defined cadenced-ringing type shall be started at the PSTN user port.

Cadenced-ringing of 8 types (0-7) shall be available. Presently 0 should be used for local and 1 for NSD/ISD calls. Others are reserved to be specified later. This has a reference to clause 13.4.7.2 of ITU-T Recommendation G.964.

3.6.2 **Pulsed signal**

The purpose of the Pulsed-signal information element sent from LE to AN is to indicate to the AN that a certain pulsed signal shall be activated at the PSTN user port. If the Pulsed-signal information element is sent from the AN to the LE it corresponds to a pulsed signal at the PSTN user port generated by the subscriber's equipment.

Out of the pulse types as mentioned in clause 13.4.7.3 of ITU-T Recommendation G.964, the following pulse types only are applicable.

i) Register Recall (Pulse type code 1110110)	Signal shall be used by AN to indicate "flash" to LE. Default value of pulse duration = 0 means 100-200 ms
ii) Meter pulse (Pulse type code 1111000) (16KHz)	Signal shall be used in the direction LE to AN, to indicate the sending of a meter pulse from user port to equipment in the customer premises. No Acknowledgement (ACK) is to be sent for meter pulse from AN to LE. Default value of pulse duration (16KHZ) = 0 means 125 ms ± 25 ms, number of pulses may be 1 to 31.

For the above pulsed-signals, both Suppression indicator and Acknowledge request indicator shall always be coded as zero.

3.6.3 **Steady signal**

The purpose of the Steady-signal information element is either to indicate to the AN that a certain steady signal shall be activated at the PSTN user port (generated by the AN) or that a particular steady signal transmitted by the subscriber's equipment has been detected at the PSTN user port which shall be reported to the LE.

Out of the steady signal types as mentioned in clause 13.4.7.4 of ITU-T Recommendation G.964, the following steady signal types only are applicable.

i	Normal polarity.	(Code =0000000)
ii	Reverse polarity (for CCB & PBX on Answer)	(Code =0000001)
iii	Off hook (loop closed)	(Code =0000100)
iv	On hook (loop open)	(Code =0000101)
v	Reduced battery: To be used for line lock out condition	(Code =0001010)
vi	Stop ringing	(Code =0001110)

3.6.4 **Digit Signal**

This shall be used from AN to LE for pulse dialling. Digit acknowledge request indicator shall be 0 as per clause 13.4.7.5 of ITU-T Recommendation G.964.

3.7. **Path Collision**

LE to AN calls shall have priority as per clause 13.5.3.3 of ITU-T Recommendation G.964.

3.8. **Signalling sequences in the event of failure**

The following sub-para indicates the signalling sequences in the event of failures of a V5.2 interface causing the user port not being returned to idle condition before releasing the signalling path.

3.8.1 **Protocol implication of going directly to the NULL state**

The user port shall be put back into the idle condition, by using the steady-signal information element on hook provided in the DISCONNECT message as per Annex. B.4.1 of ITU-T Recommendation G.964.

3.8.2 **Leaving the BLOCKED state**

The following sub-para indicates the signalling sequences to bring a port that was previously in the blocked state, back into service.

The port shall be put back into the idle condition under the control of the AN without any intervention from the LE as per Annex. B.5 of ITU-T Recommendation G.964.

3.9. **Ring signals and their placement in V5-messages**

In order to allow the LE to signal a ring tone back to the calling subscriber knowing with a high degree of certainty that ringing has indeed been applied, the cadence-ring information element should be placed in the ESTABLISH message. By returning an ESTABLISH ACK message, the AN is confirming both that it has received the ESTABLISH message and that it has the resources required in order to ring from the user port. This may only be achieved in this fashion if the cadence-ring signal is placed in and hence protected by, the ESTABLISH/ESTABLISH ACK message pair. Once the ESTABLISH ACK message has been received by the LE it will send the ring

back tone but not before. In the event of no ESTABLISH ACK message being received within the correct time, the LE shall retry the call only once as mentioned in the timer table (Table 28 of ITU-T Recommendation G.964).

For terminating subscriber with CLIP category, cadence ring type shall go in Signal message from LE to AN.

These protocols have been defined in detail in Annex. B.10 of ITU-T Recommendation G.964.

3.10. **Signalling sequence for different call scenarios**

Annexure-I gives the examples for different call scenarios explaining the application of various information elements for which national options have been defined in this document. For all other call scenarios (normal and abnormal) relevant clauses of ITU-T Recommendation G.964 and G.965 shall be applicable.

3.10.1 CLIP-A shall be implemented as per TEC GR SR/ASF-01. The exchange of messages for CLIP-A between LE and AN shall be as per flow diagram shown in Annexure-I

3.11. National options for PSTN signalling protocol are defined in the above paragraphs to suit the requirements of the national PSTN. All other requirements for V5.2 interface shall be as per ITU-T Recommendations G.965 (1995) except following clauses which shall be as per ITU-T Recommendations G.965 (2001).

3.12. **Elements of procedures and formats of fields for data link sub layer peer-to-peer communication**

i) The control field that identifies the type of frame shall be as per clause 10.3.3 of ITU-T Recommendations G.965 (2001).

ii) The various parameters associated with the control field shall be as per clause 10.3.4 of ITU-T Recommendations G.965 (2001).

iii) Frame type shall be as per clause 10.3.5 of ITU-T Recommendations G.965 (2001).

3.13. **Reject cause information element**

The structure of the Reject Cause information element shall be as per clause 17.4.2.5 of ITU-T Recommendations G.965 (2001).

3.14. **Protection protocol specification**

Protection protocol shall be as per clause 18 of ITU-T Recommendations G.965 (2001).

3.15. **Interoperability**

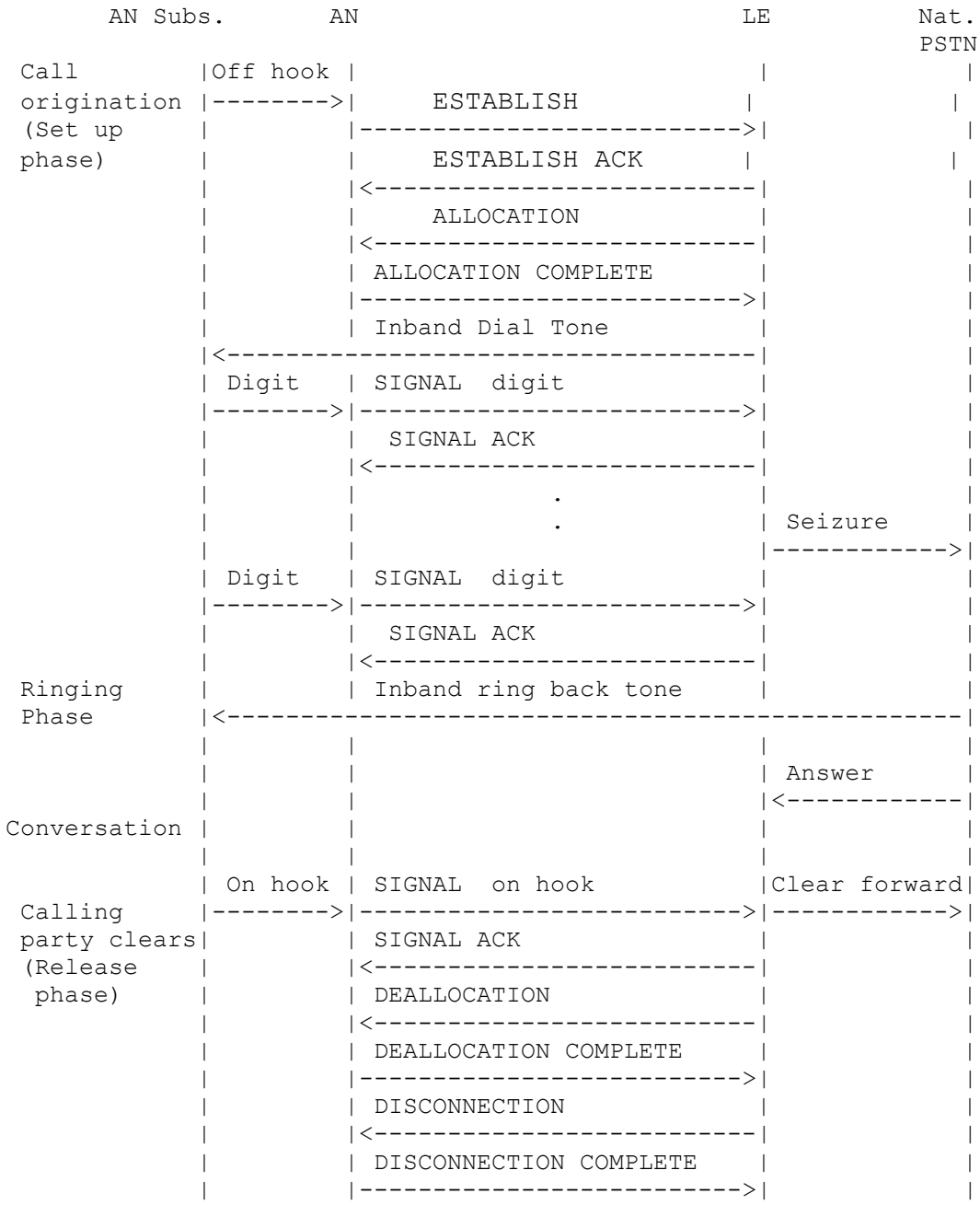
The interoperability between different versions of V5.2 standards shall be as per annex L of ITU-T Recommendations G.965 (2001).

3.16. While giving technical compliance statement against this national standard, clause by clause compliance for Recommendation G.965 (1995) and relevant paras of G.964 (1994) of ITU-T shall be given. Compliance statement for Recommendation G.965 (2001) for clause no. 10.3.3, 10.3.4, 10.3.5, 17.4.2.5, 18 and annex L shall also be given.

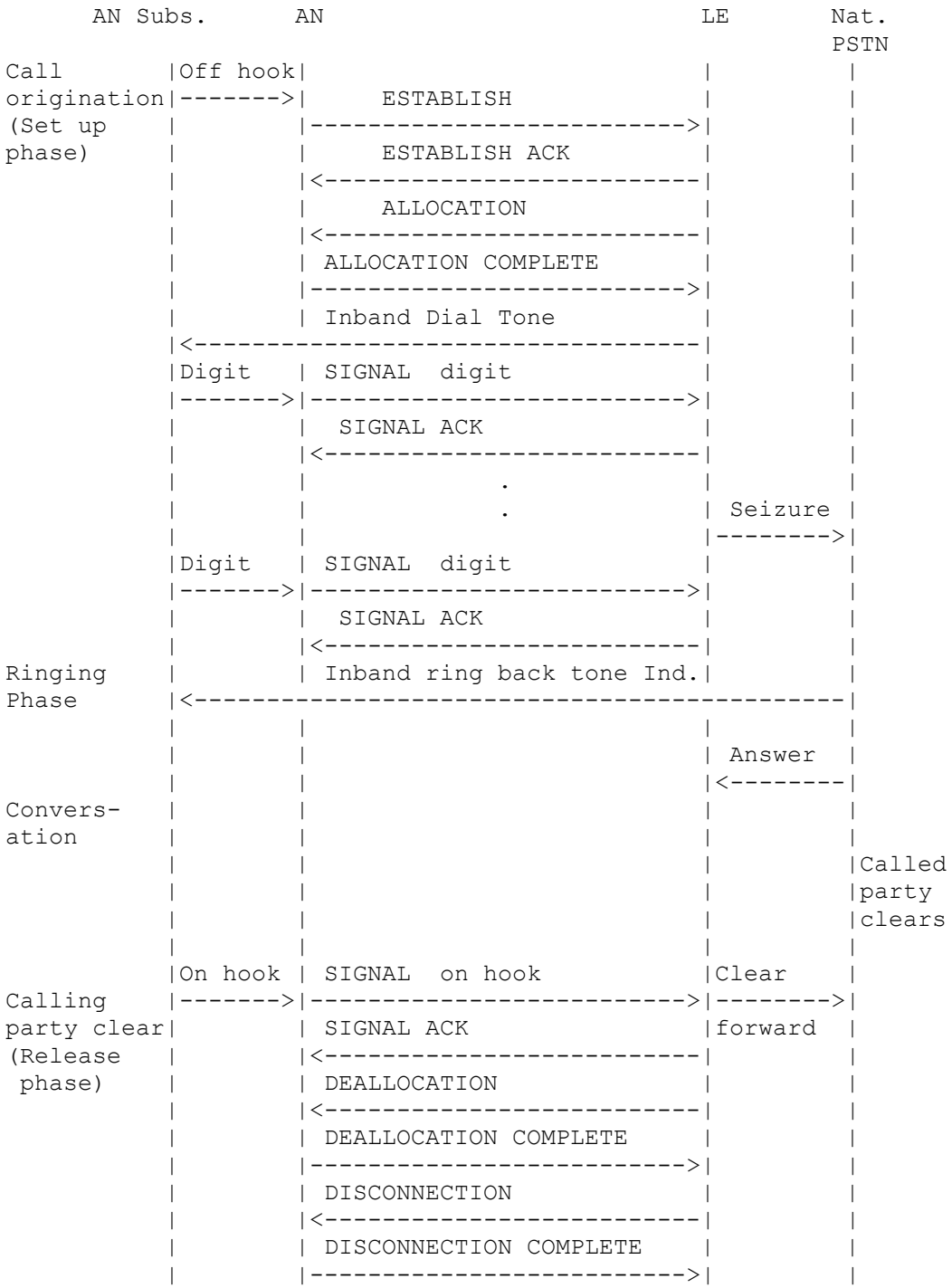
ANNEXURE-I

DIFFERENT CALL SCENARIOS

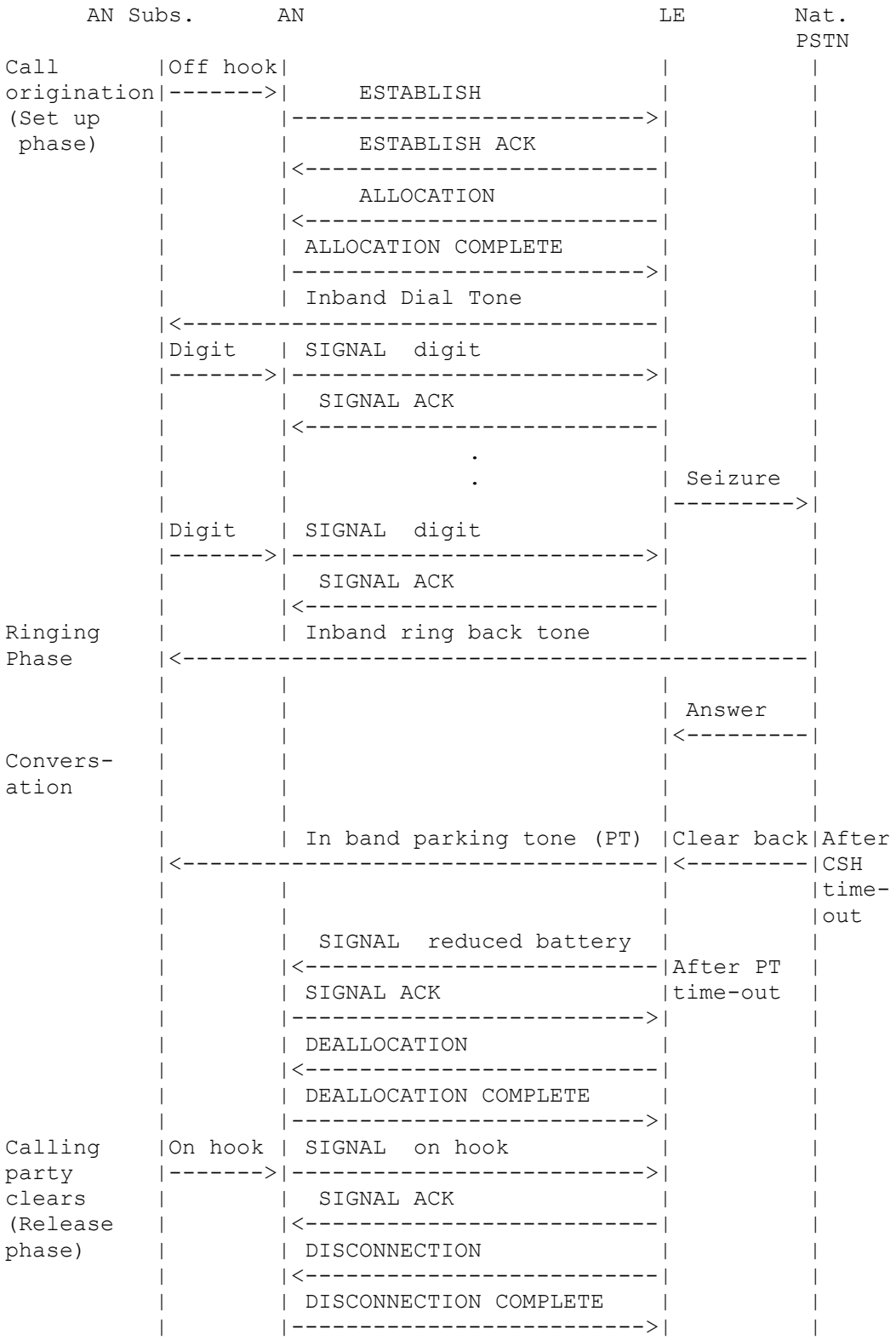
AN ORIGINATED CALL (Calling Party Clears first)



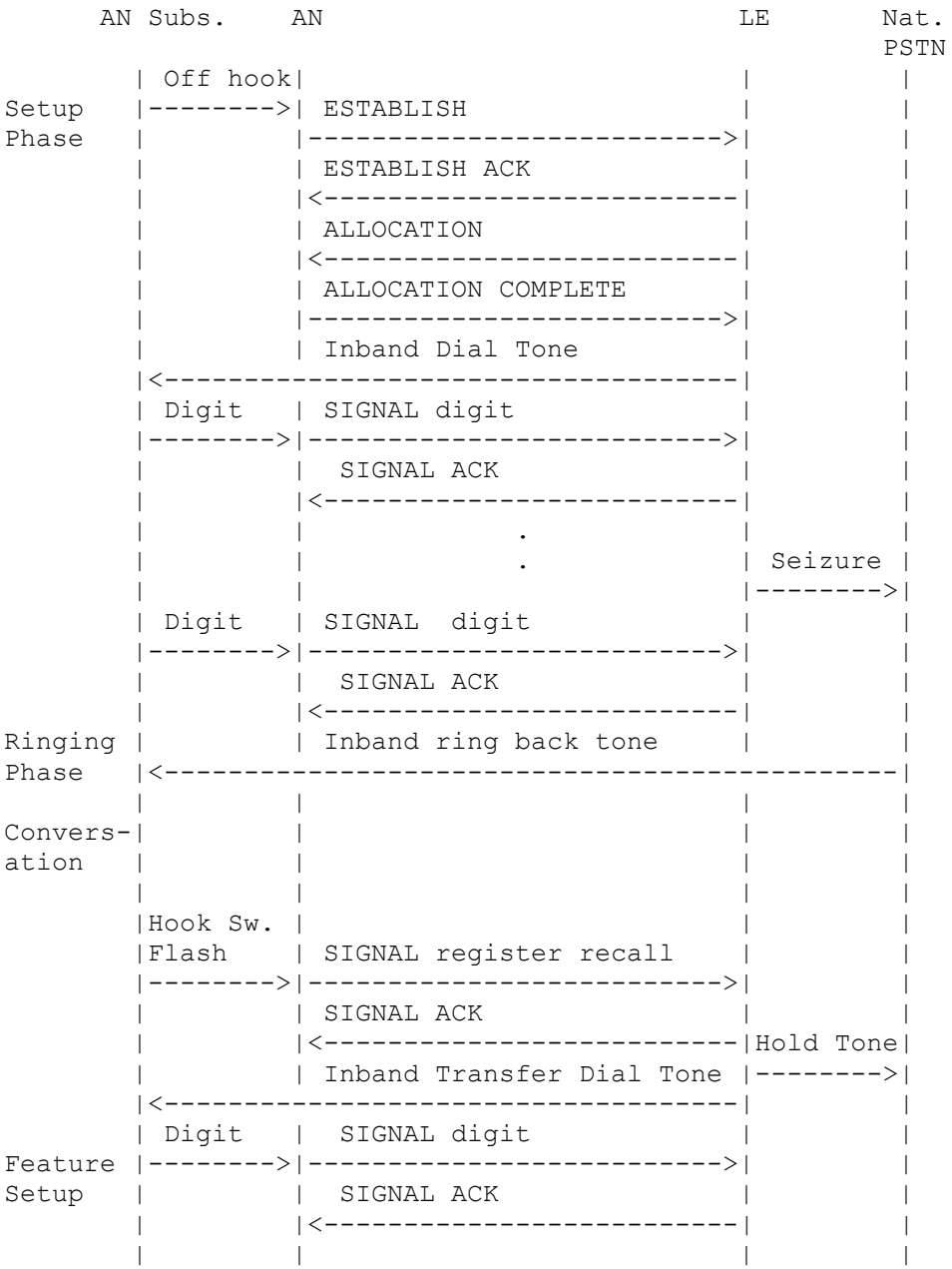
AN ORIGINATED CALL
(Called Party Clears first and Calling Clears before CSH Time-out)



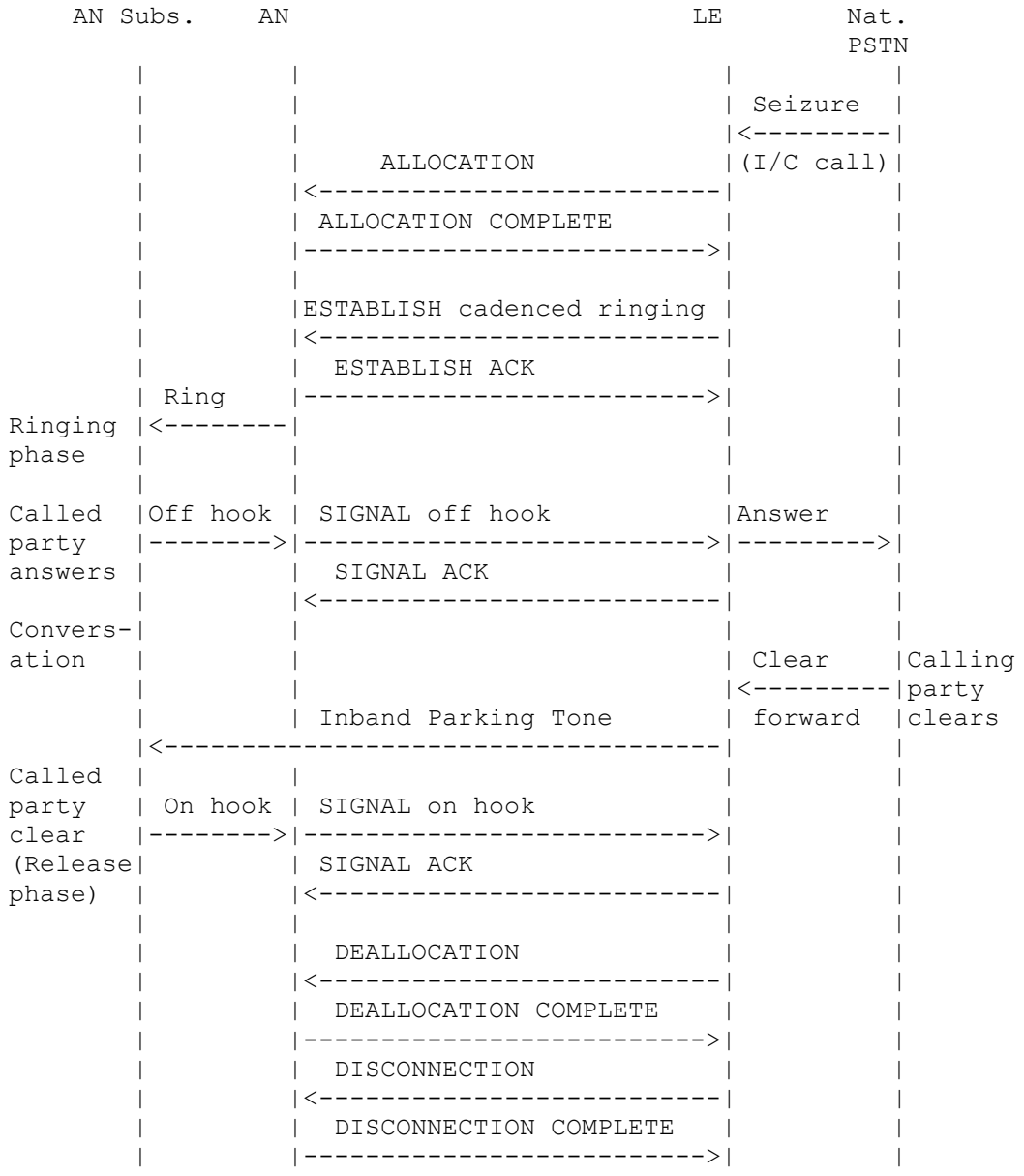
AN ORIGINATED CALL (Called Party Clear LLO case)



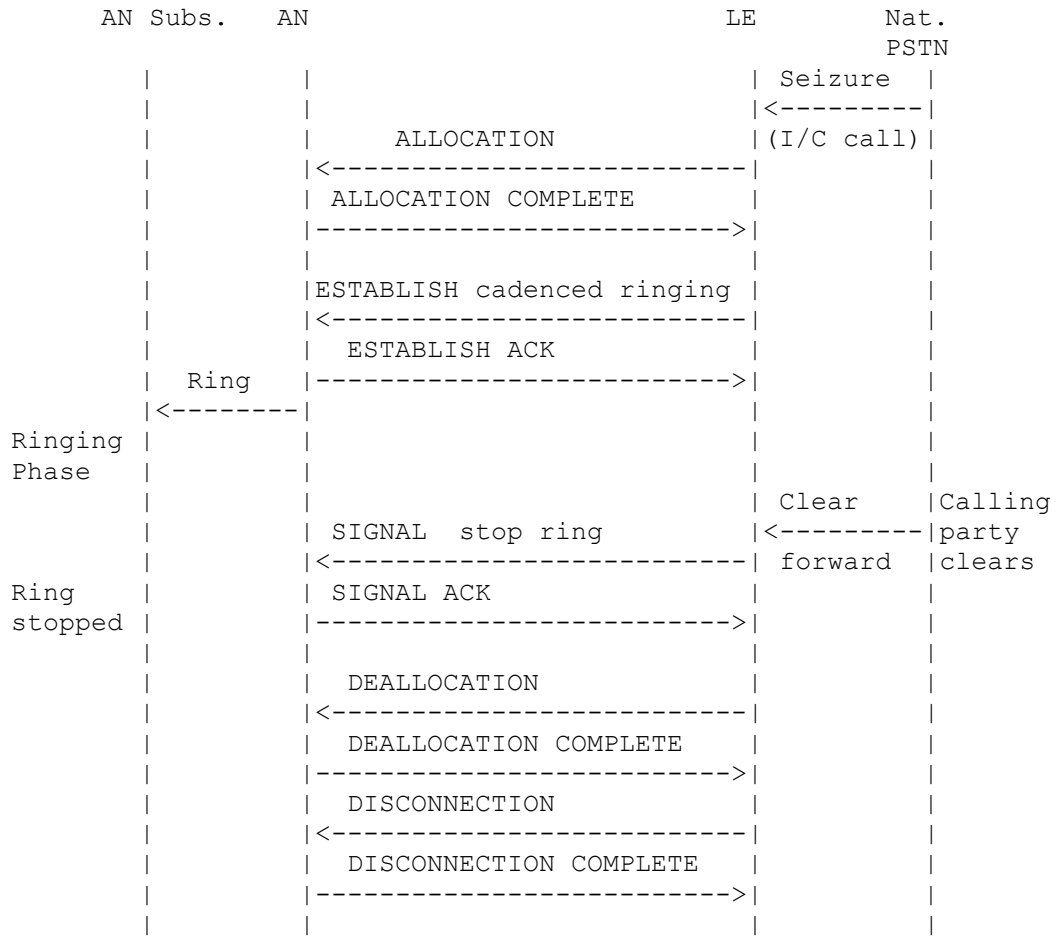
AN ORIGINATED CALL (Subscriber Hook Switch Flash)



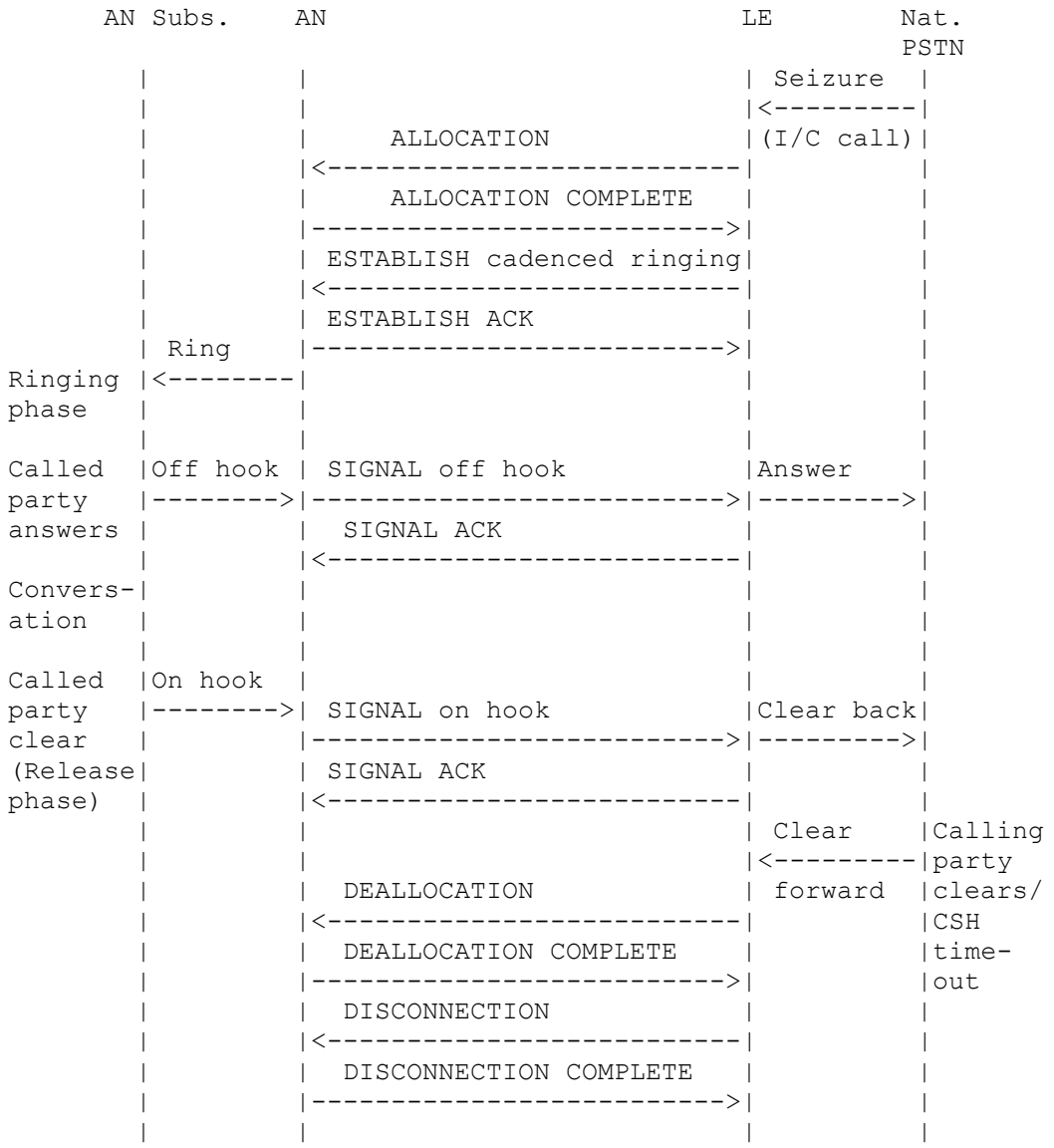
PSTN ORIGINATED CALL (Calling Party Clears)



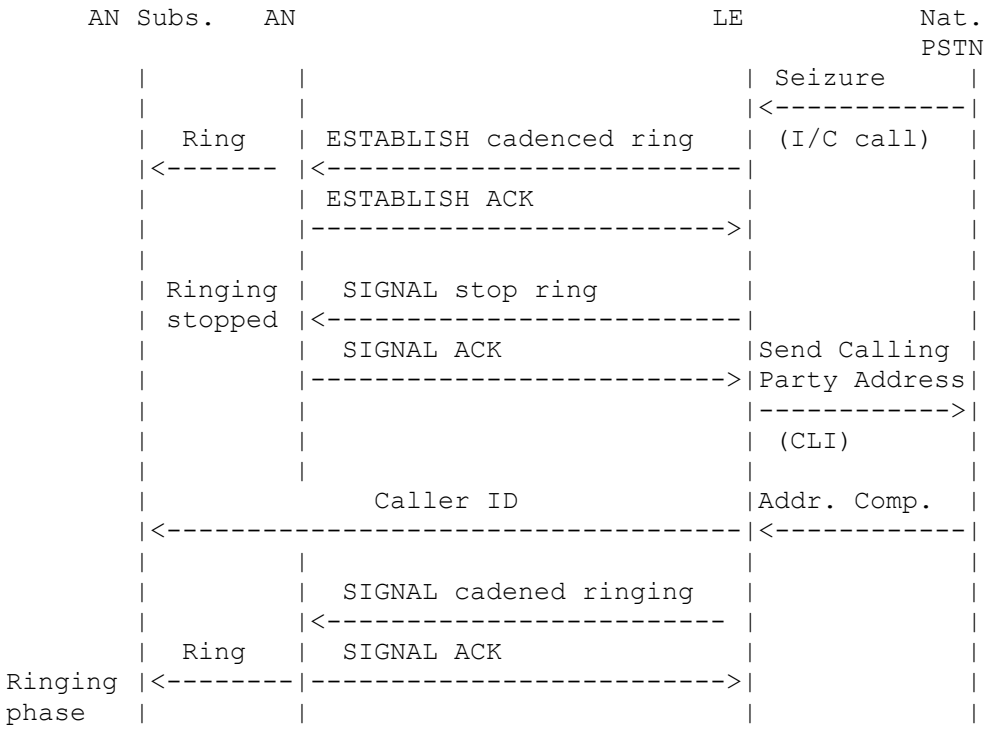
PSTN ORIGINATED CALL (Calling Party Clears in Ringing)



PSTN ORIGINATED CALL (Called Party Clears)

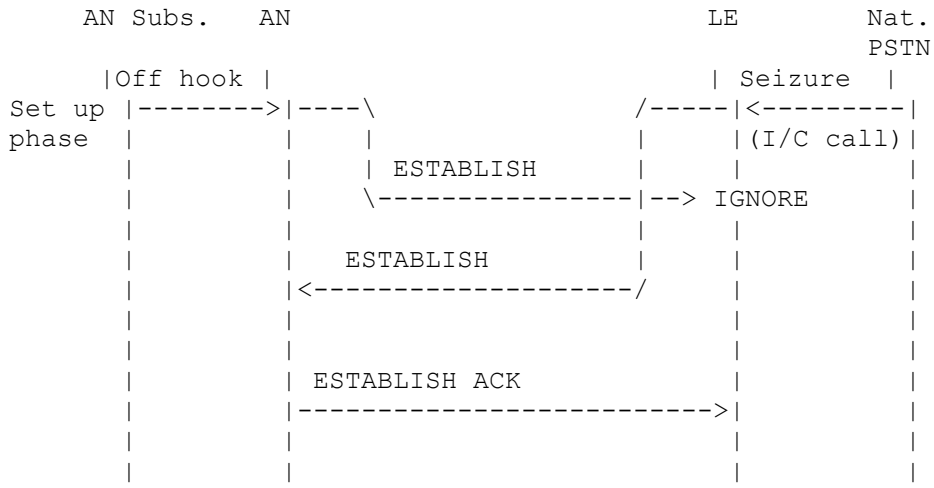


PSTN ORIGINATED CALL (Caller ID Feature)



For CLIP suscribers, the digit shall be collected in-band on the voice channel.

CALL COLLISION (Priority Terminating Call)



ABBREVIATIONS

ACK	Acknowledgement
AN	Access Network
APA	Accelerated Port Alignment
BCC	Bearer Channel Connection
CCB	Coin Collecting Box
CLI	Calling Line Identity
CLIP	Calling Line Identification Presentation
CSH	Called Subscriber Held
DTMF	Dual Tone Multi-Frequency
ETSI	European Telecommunication Standards Institute
HOOK SW	Hook Switch
I/C	Incoming
ID	Identification
ISD	International Subscriber Dialling
ISDN	Integrated Services Digital Network
ITU-T	International Telecommunication Union - Telecommunication Sector
KHz	Kilo Hertz
LE	Local Exchange
MML	Man Machine Language
ms	Milli Seconds
NSD	National Subscriber Dialling
OSI	**O**pen **S**ystem **I**nterconnection
PBX	Private Branch Exchange
PCM	Pulse Code Modulation
POTS	Plain Old Telephone
PSTN	Public Switched telephone Network
SUBS	Subscriber
TS	Time Slot

REFERENCES

1. TEC GRs

S.NO.	Title	Document number
1.	Service Description for Analog Subscribers	SR/ASF-01/03.MAR2003

2. ITU Recommendations

S.NO.	Documents
1.	ITU-T G. 964, 965

3. ETSI Recommendations

S.NO.	Documents
1.	ETSI 300 347-1